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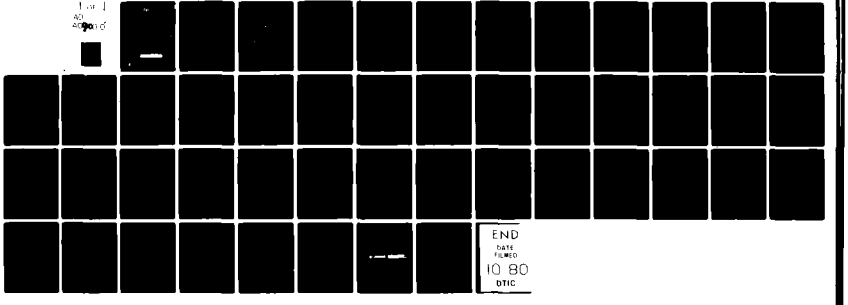

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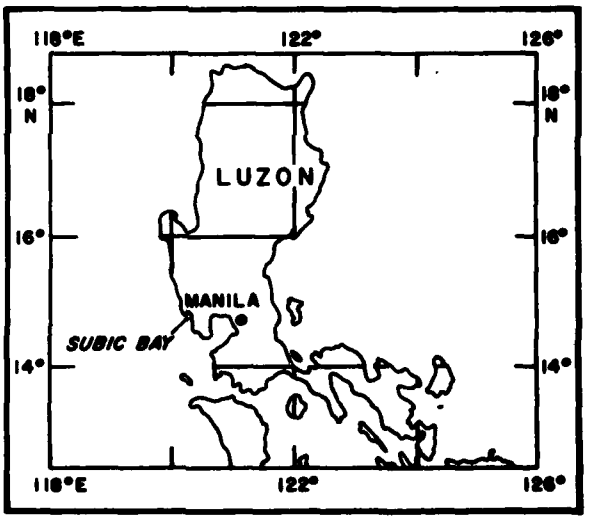
INFORMAL REPORT

ENVIRONMENTAL DATA REPORT SUBIC BAY, REPUBLIC OF THE PHILIPPINES, JANUARY AND FEBRUARY 1965



APRIL 1970

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NAVAL OCEANOGRAPHIC OFFICE
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INFORMAL REPORT

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ABSTRACT

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965. The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program. Temperature and salinity measurements and bottom sediment samples were obtained at 10 stations. Two of these stations were time-series anchor stations with current measurements and ambient noise recordings.

The influence of tidal currents are thought to be responsible for the fluctuation of higher density waters through the entrance channel to Subic Bay on either slope of predicted high water.

Maximum current speed was 0.4 knot. Characteristically, flow direction at intermediate levels often differed from the flow of the surface and near-bottom depths.

DALE E. KENNEY
Nearshore Surveys Division
Oceanographic Surveys Department

This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Report.

L. B. BERTHOLF
Director, Nearshore Surveys Divison

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I. INTRODUCTION

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965 from USS ENERGY (MSO 436) and USS ABNAKI (ATF 96). The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program.

Ten Nansen cast stations were occupied: seven stations along a track in the approaches to Subic Bay on 22 January and three stations, two of which were time-series anchor stations with current measurements and ambient noise recordings, in the entrance channel between Grande Island and Macmany Point from 17 to 19 Februar· (Fig. 1). A station data summary is presented in Table I.

Subic Bay is a deep, semi-enclosed basin with steep sides and a generally mud bottom. The bay gradually shallows from the entrance channel near Grande Island northward to the shoreline. The climatology is largely influenced by the monsoons and the trade winds. Current flow seaward of Subic Bay generally sets northward throughout the year with the stronger currents associated with the summer months. The northeast monsoon, November to March, brings weaker currents and drier weather.

II. METHODS OF COLLECTION AND ANALYSIS

A. Temperature.

Six to 12 Nansen bottles were used per cast, and with the exception of station 1, only paired, protected reversing thermometers were utilized. By alternating individual thermometers and forming new pairs, a reliable temperature relationship among the thermometers was established. Consequently, a correction factor could be applied to certain thermometers that had consistent errors. This factor, along with the standard thermometer corrections, was applied to the temperature values, and temperatures are considered accurate to $\pm$0.02°C.

B. Salinity.

Water samples were drawn from Nansen bottles, and salinity determinations were made in the field with an Industrial Instruments RS-7A induction salinometer. With this instrument, salinity can be measured with a precision of $\pm$0.003 o/oo. In consideration of the probable sources of error, instrumental and observational, an accuracy of $\pm$0.01 o/oo is realistic for this survey.

C. Bottom Sediments.

Kullenberg cores were obtained at stations 8, 9, and 10. The samples were analyzed in the field for engineering properties and

sediment size and composition. Some distortion in the cores resulted before analysis, and the values obtained for the engineering properties are questionable.

D. Current Measurements.

Five Roberts current meters were used to obtain currents at the time-series stations. Because of the proximity of stations 9 and 10, the data are presented as one continual station covering a 36-hour period (24 and 16 hours each, respectively). The time gap occurred in the record when ship relocation and equipment malfunction halted operations. Current observation depths ranged from the surface to near bottom.

The calibration limitations of the Roberts current meter is 0.2 to 5.0 knots. Many values obtained were near 0.1 knot, which is the approximate threshold level for the meter. If a discernable record was attained near the threshold level, the measurement was included in the analysis. Of the 128 current observations attempted, approximately 35 percent were unusable and an additional 16 percent of the observations showed current speeds below the threshold level of the meters. The current directional values are considered accurate to $\pm$10 degrees.

E. Ambient Noise.

Ambient noise was measured with an AN/PQM-1A Noise Level Meter. The meter has a frequency range of 20 to 40,000 Hz and a pressure level range of 30 to 145 decibels referred to a reference level of 0.0002 dynes/cm^2.

The hydrophone was mounted on a tripod located 180 meters east of station 10 at a depth of 24 meters. Recordings were obtained for 3-minute intervals 30 minutes before sunrise and 30 minutes after sunset. The calibration and the recording of ambient noise followed the technique outlined in the AN/PQM-1A instruction manual. The data obtained were analyzed on an 8-channel Sanborn recorder using a B&K 3rd octave spectrometer. The values used in this report are the average sound pressure level of the central frequency of each 1/3 octave corrected for attenuation, cable, and equipment loss. The resulting sound pressure levels then were reduced to sound pressure spectrum levels for analysis.

F. Meteorological and Tide Observations.

NAVOCEANO personnel obtained meteorological observations either visually or by hand-held equipment. Tide values used in this report are predicted values from USC&GS tide tables with Manila as the reference station.

III. DISPOSITION OF DATA

The serial-depth temperature and salinity values were computer processed at NAVOCEANO. Machine listings provided electrical conductivity, density (sigma-t), and sound velocity determinations for each depth. The computer-processed station data sheets are presented in Appendix A.

The core analysis summary sheets are presented in Appendix B. Original current data and ambient noise recordings are retained at NAVOCEANO.

IV. PRELIMINARY ANALYSES

A. Temperature.

A temperature cross section of stations 1 through 7 is shown in Figure 2. A density-time-depth composite for Station 10, indirectly depicting the hourly thermohaline variations occurring for each recorded depth, is presented in Figure 3.

Temperature measurements taken hourly during the time-series stations showed that the maximum horizontal fluctuation did not exceed 1.1°C for any measured depth over the 36-hour period of observations. Measurements of the vertical temperature range revealed a maximum variation of 1.6°C within the water column. Relatively little fluctuation in horizontal temperature was evident while occupying Station 9. With the advent of the following flood tide, subsequent changes in the temperature and salinity structure resulted in density fluctuations for all observed subsurface depths (Fig. 3). The increases in density appeared on either slope of predicted High Water.

B. Salinity.

Salinity values ranged from 33.49 to 34.47 o/oo. Figure 4 is a salinity cross section for stations 1 through 7. Observations taken during the time-series stations showed a maximum hourly range in vertical salinity of 0.34 o/oo. For any one observed depth, maximum horizontal fluctuation in salinity was 0.25 o/oo. The stability of the water column for the first 24 hours (Station 9) was attested to by a maximum horizontal fluctuation of 0.11 o/oo. Subsequent measurements revealed slight increases in salinity accompanying the temperature decreases, resulting in the density fluctuations depicted in Figure 3.

C. Bottom Sediments.

The core samples showed a generally greenish-colored sand with high contents of clays and silts. Calcium carbonate comprised, by weight, 18 to 37 percent of the samples' mineral composition. Quartz and calcite were the dominant and secondary minerals, respectively. The high standard deviations evident in the sediment size analyses attest to the poorly sorted nature of the sediments.

D. Current Measurements.

Current measurements also are depicted in Figure 3. Maximum recorded current speed was 0.4 knot. Current speed and direction varied throughout the water column. Characteristically, flow direction at intermediate levels often differed from the flow at the surface and near-bottom depths. Observed near-bottom flow was an inflowing current for the full 36-hour period regardless of the tidal cycle. Surface currents appeared to be in harmony with the tidal cycle more so than subsurface flows: The termination of a tidal period generated a reversal in surface flow direction. The increases in density at Station 10 indicated a fluctuation of higher density water through the entrance channel as a result of tidal currents.

E. Ambient Noise.

Recognizable sound sources evident to the observers were snapping shrimp and a channel buoy. Therefore, the recording times were chosen to correspond to the periods of maximum activity of snapping shrimp, which were thought to be the dominant noise source. The rise in the sound pressure level between 2kHz and 20kHz (Fig. 5) is compatible with prior research[1] on the role of snapping shrimp in the production of underwater noise. Observed sea state levels did not exceed "two" during the recordings, and Knudsen's curves for ambient noise levels[2] are presented in Figure 5.

Transient noise anomalies were present in the lower frequencies, especially during the morning recordings. The occurrence of the transient noise anomalies decreased from a maximum in the 40 to 125Hz band widths to an insignificant amount over 2.5kHz. Besides the sound from the channel buoy and random noises from the listening ship, the low frequency transient noise sources were not identifiable.

---

[1] M.W. Johnson, F.A. Everest, and R.W. Young. 1947. The Role of Snapping Shrimp (Crangon and Synalpheus) in the Production of Underwater Noise in the Sea. Biol. Bull. Woods Hole, 93(2): 122-138.

[2] V.M. Albers. 1965. Underwater Acoustic Handbook II. Pennsylvania State University Press.

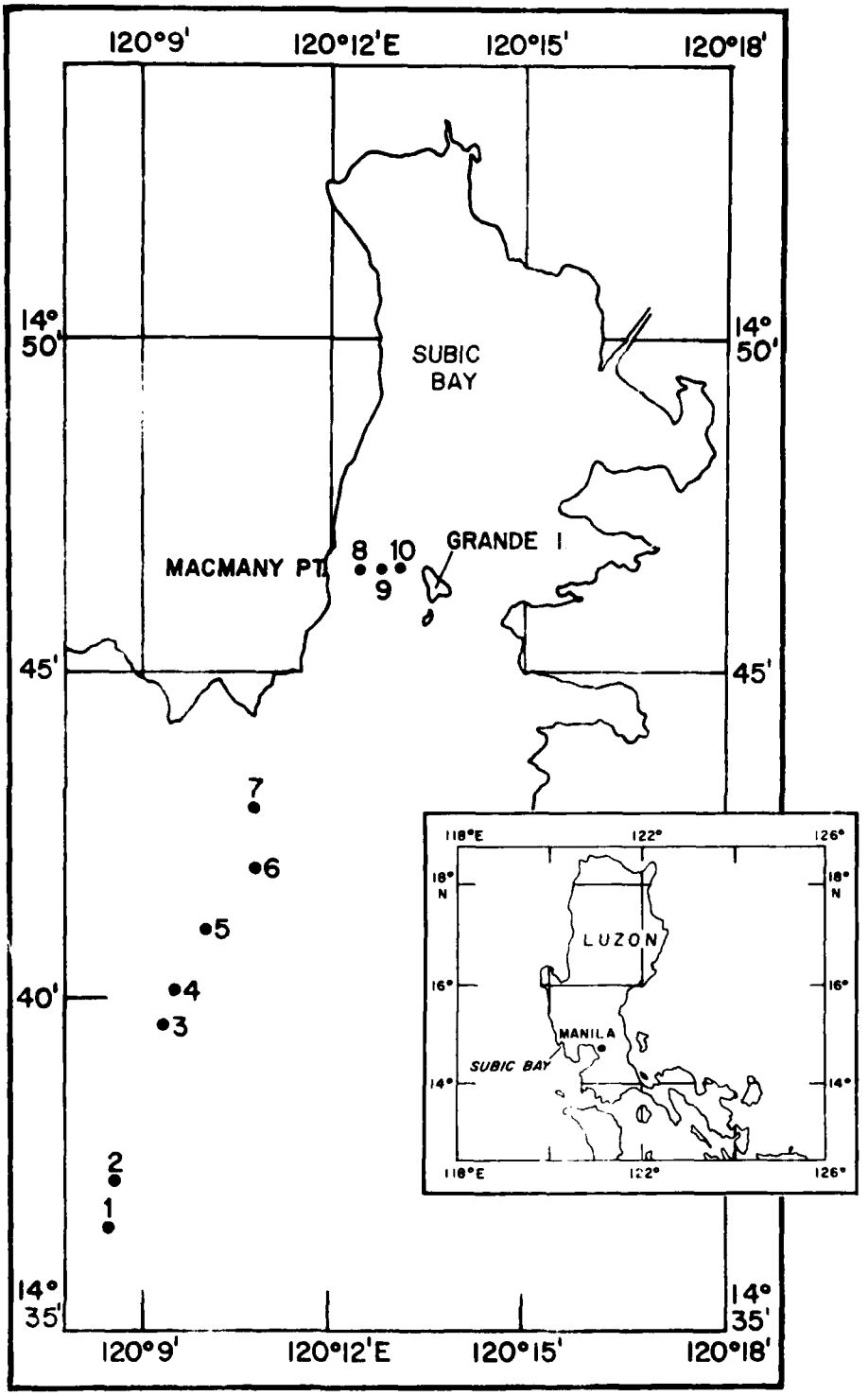

Figure 1. Station Locations

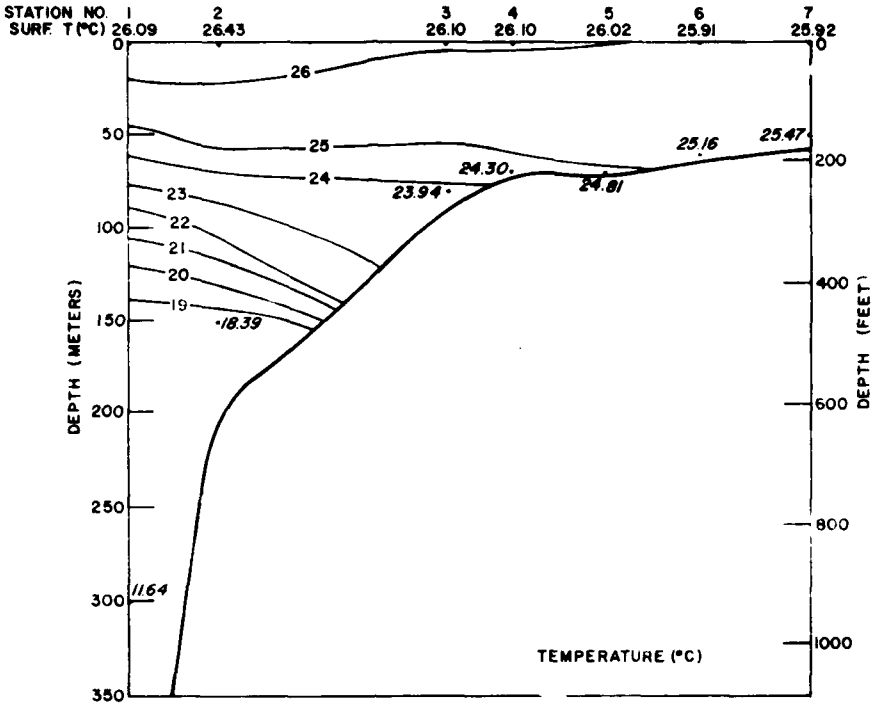

Figure 2. Temperature Cross Section - Stations 1 to 7

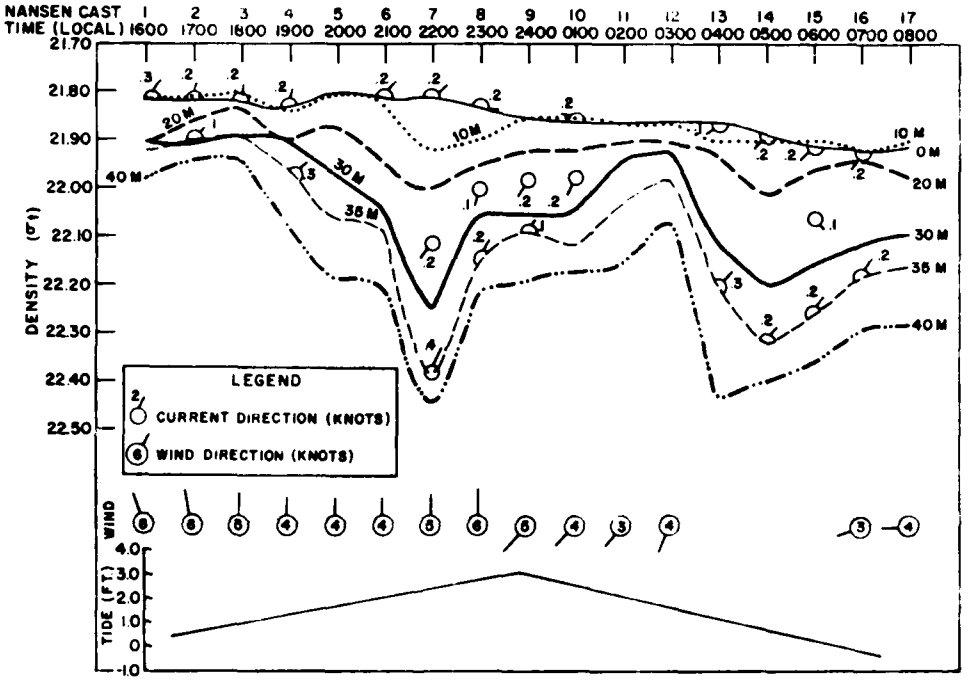

Figure 3. Density-Time-Depth Composite at Station 10

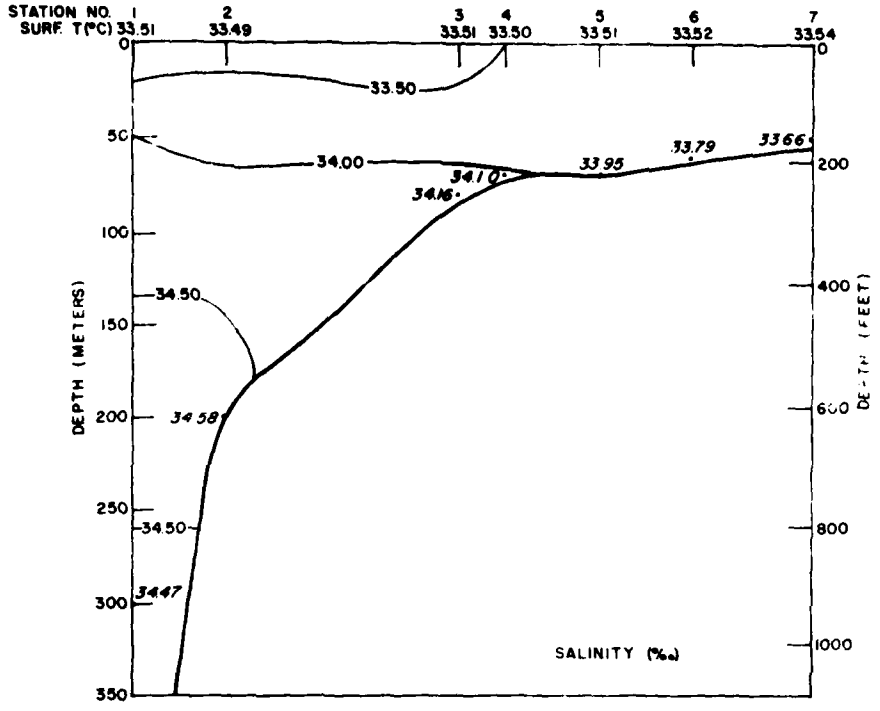

Figure 4. Salinity Cross Section - Stations 1 to 7

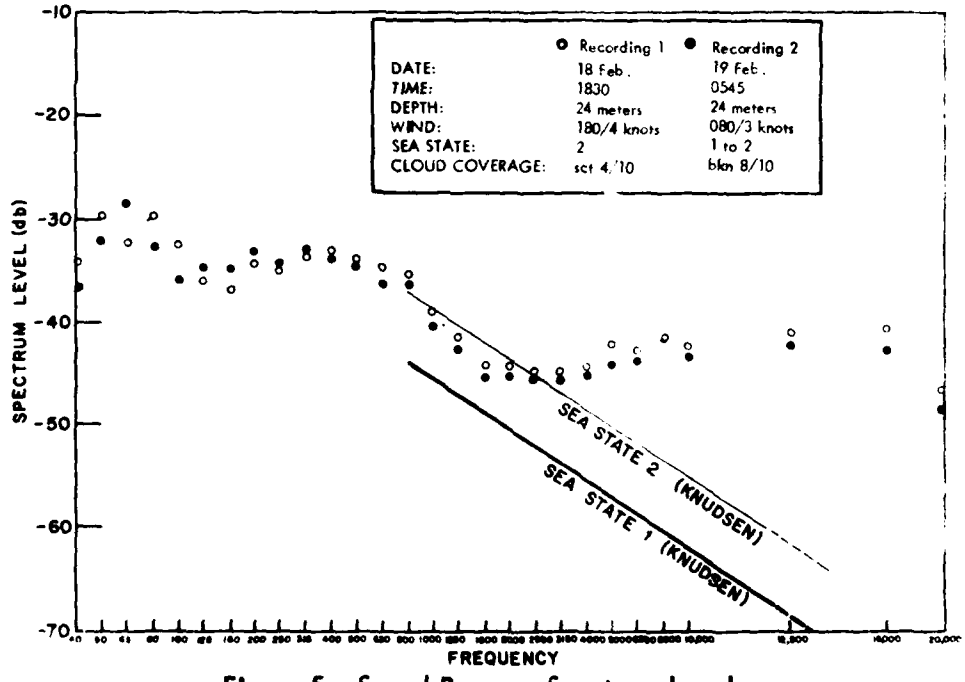

Figure 5. Sound Pressure Spectrum Level

TABLE 1. STATION DATA SUMMARY

Sta. No.	Latitude (°N)	Longitude (°E)	Depth (meters)	Nansen Casts	Current Meter Lowerings	Cores	Ambient Noise Recordings
1	14°36.30'	120°08.60'	713	1			
2	14°37.25'	120°08.70'	205	1			
3	14°39.60'	120°09.30'	91	1			
4	14°40.20'	120°09.70'	73	1			
5	14°41.05'	120°10.20'	73	1			
6	14°42.00'	120°10.50'	64	1			
7	14°43.00'	120°11.25'	58	1			
8	14°46.60'	120°12.30'	60	1	1	1	
9	14°46.60'	120°12.60'	55	24	17	1	
10	14°46.60'	120°12.90'	43	17	15	1	2

APPENDIX A

Oceanographic Station Data

EXPLANATION OF COMPUTER DATA SHEET
OCEANOGRAPHIC STATION DATA

1. CRUISE. A number assigned to each cruise for identification purposes. The first two digits are the mine division number, the next three digits are the ship's hull number, and the last digit is the end digit of the year.

2. STATION. The station identification consists of an area abbreviation (SEA = Southeast Asia), a region number, and a consecutive station number for the cruise.

3. LATITUDE. Expressed in degrees, minutes, and tenths of minutes.

4. LONGITUDE. Expressed in degrees, minutes, and tenths of minutes.

5. MARSDEN SQUARE. A 10-degree geographical square used for cataloging data.

6. DATE. Day, month, and year when data were taken.

7. TIME. Time of day when data were taken in local time.

8. ZONE. Time zone for converting local time to GMT.

9. DEPTH. Depth of water in meters where station was taken.

10. AIR TEMP. Temperature of the air in °F when station was taken.

11. TEMP INSTR. Type of temperature recording instrument used for collecting the water temperatures (RTH= reversing oceanographic thermometer, MBT= mechanical bathythermograph).

12. SAL INSTR. Type of instrument used to obtain salinity samples of water (NAN= Nansen bottle).

13. DEPTH. Depth in meters at which each temperature and salinity sampling was made.

14. DEV. The ± range of depth over which actual sampling depth may deviate from given sampling depth.

15. TEMP. Water temperature in °C at each sampling depth.

16. DEV. The ± range of temperature over which actual temperature may deviate from given temperature value.

17. SALINITY. Water salinity in parts per thousand at each sampling depth.

18. DEV. The ± range of salinity over which actual salinity may deviate from the given value.

19. ELEC. COND. The electrical conductivity of the water in mhos/cm^2 calculated from the values of temperature and salinity with the empirical equation of Ribe and Howe, "An Empirical Equation Relating Sea Water Salinity, Temperature, Pressure, and Electrical Conductivity."

20. DEV. The ± range of electrical conductivity over which the actual conductivity may deviate from the given value, computed from the deviations of temperature and salinity.

21. SIGMA-T. An abbreviated expression for density (density= Sigma-t/ 1000 + 1) g/cm^3 calculated with the equation of Knudsen using the given temperature and salinity values.

22. DEV. The ± range of Sigma-t over which the actual Sigma-t may deviate from the given value, computed from the deviations of temperature and salinity.

23. SOUND VEL. The velocity of sound in sea water at each depth, in meters per second, calculated from the given values of depth, temperature, and salinity using Wilson's equations of 1960, NAVOCEANO Special Publication 58, "Tables of Sound Speed in Sea Water."

24. DEV. The ± range of sound velocity over which the actual sound velocity may deviate from the given value, computed from the deviations of depth, temperature, and salinity.

CRUISE 924365 STATION SEA 4 1 LATITUDE 14 36.3 N LONGITUDE 120 8.6 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1050 ZONE -8 DEPTH 713 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.1	0.02	33.51	0.01	0.0521	0.0000	21.90	0.00	1535.7	0.07
10.	1.00	26.0	0.02	33.51	0.01	0.0521	0.0000	21.92	0.00	1535.7	0.07
20.	1.00	26.0	0.02	33.50	0.01	0.0520	0.0000	21.93	0.00	1535.8	0.07
30.	1.00	26.0	0.02	33.51	0.01	0.0520	0.0000	21.94	0.00	1536.0	0.07
50.	1.00	24.7	0.02	34.04	0.01	0.0514	0.0000	22.74	0.00	1533.9	0.08
75.	1.00	23.3	0.02	34.27	0.01	0.0503	0.0000	23.33	0.00	1531.0	0.08
100.	1.00	21.2	0.02	34.42	0.01	0.0484	0.0000	24.03	0.00	1526.2	0.08
150.	1.00	18.2	0.02	34.55	0.01	0.0465	0.0000	24.90	0.00	1519.0	0.09
200.	1.00	15.0	0.02	34.58	0.01	0.0424	0.0000	25.66	0.00	1510.0	0.09
242.	1.00	13.2	0.02	34.61	0.01	0.0407	0.0000	25.98	0.00	1505.0	0.10
300.	1.00	11.6	0.02	34.47	0.01	0.0381	0.0000	26.26	0.00	1500.5	0.10
464.	1.00	8.7	0.02	34.49	0.01	0.0363	0.0000	26.74	0.00	1492.4	0.10

CRUISE 924365 STATION SEA 4 2 LATITUDE 14 37.2 N LONGITUDE 120 8.7 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1240 ZONE -8 DEPTH 20 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.49	0.01	0.0524	0.0000	21.78	0.00	1536.5	0.07
10.	1.00	26.1	0.02	33.49	0.01	0.0521	0.0000	21.88	0.00	1535.9	0.07
20.	1.00	26.1	0.02	33.51	0.01	0.0521	0.0000	21.91	0.00	1536.0	0.07
30.	1.00	26.0	0.02	33.52	0.01	0.0520	0.0000	21.96	0.00	1535.9	0.07
50.	1.00	25.6	0.02	33.64	0.01	0.0518	0.0000	22.15	0.00	1535.5	0.07
75.	1.00	23.7	0.02	34.23	0.01	0.0506	0.0000	23.18	0.00	1532.0	0.08
100.	1.00	22.5	0.02	34.35	0.01	0.0496	0.0000	23.61	0.00	1529.5	0.08
150.	1.00	18.4	0.02	34.54	0.01	0.0457	0.0000	24.84	0.00	1519.5	0.09
200.	1.00	-0.0	-0.00	34.58	0.01	0.0287	0.0000	27.79	0.01	1452.0	0.03

CRUISE 924365 STATION SEA 4 3 LATITUDE 14 39.6 N LONGITUDE 120 9.3 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1350 ZONE -8 DEPTH 91 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.1	0.02	33.51	0.01	0.0521	0.0000	21.90	0.00	1535.7	0.07
10.	1.00	25.9	0.02	33.50	0.01	0.0519	0.0000	21.96	0.00	1535.4	0.07
20.	1.00	25.9	0.02	33.50	0.01	0.0519	0.0000	21.97	0.00	1535.6	0.07
40.	1.00	25.9	0.02	33.50	0.01	0.0519	0.0000	21.97	0.00	1535.9	0.07
60.	1.00	24.7	0.02	34.08	0.01	0.0514	0.0000	22.68	0.00	1534.0	0.08
80.	1.00	23.7	0.02	34.16	0.01	0.0508	0.0000	23.05	0.00	1532.7	0.08

CRUISE 924365 STATION SEA 4 4 LATITUDE 14 40.2 N LONGITUDE 120 9.7 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1425 ZONE -8 DEPTH 73 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.1	0.02	33.50	0.01	0.0521	0.0000	21.89	0.00	1535.7	0.07
10.	1.00	25.9	0.02	33.50	0.01	0.0519	0.0000	21.95	0.00	1535.5	0.07
25.	1.00	25.9	0.02	33.50	0.01	0.0519	0.0000	21.97	0.00	1535.6	0.07
40.	1.00	25.8	0.02	33.51	0.01	0.0519	0.0000	21.98	0.00	1535.8	0.07
55.	1.00	25.4	0.02	33.73	0.01	0.0517	0.0000	22.29	0.00	1535.2	0.07
70.	1.00	24.3	0.02	34.10	0.01	0.0511	0.0000	22.89	0.00	1533.3	0.08

CRUISE 924365 STATION SEA 4 5 LATITUDE 14 41.0 N LONGITUDE 120 10.2 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1500 ZONE -8 DEPTH 73 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.0	0.02	33.51	0.01	0.0521	0.0000	21.93	0.00	1535.5	0.07
10.	1.00	25.9	0.02	33.51	0.01	0.0520	0.0000	21.96	0.00	1535.5	0.07
25.	1.00	25.9	0.02	33.51	0.01	0.0519	0.0000	21.98	0.00	1535.6	0.07
40.	1.00	25.7	0.02	33.66	0.01	0.0518	0.0000	22.06	0.00	1535.6	0.07
55.	1.00	25.6	0.02	33.62	0.01	0.0518	0.0000	22.13	0.00	1535.7	0.07
70.	1.00	24.3	0.02	33.95	0.01	0.0514	0.0000	22.63	0.00	1534.4	0.08

CRUISE 924365 STATION SEA 4 6 LATITUDE 14 42.0 N LONGITUDE 120 10.5 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1535 ZONE -8 DEPTH 64 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	25.9	0.02	33.52	0.01	0.0520	0.0000	21.97	0.00	1535.3	0.07
10.	1.00	25.8	0.02	33.52	0.01	0.0519	0.0000	21.99	0.00	1535.3	0.07
25.	1.00	25.8	0.02	33.52	0.01	0.0518	0.0000	22.01	0.00	1535.4	0.07
39.	1.00	25.6	0.02	33.59	0.01	0.0517	0.0000	22.11	0.00	1535.3	0.07
49.	1.00	25.6	0.02	33.61	0.01	0.0518	0.0000	22.13	0.00	1535.5	0.07
59.	1.00	25.2	0.02	33.79	0.01	0.0516	0.0000	22.40	0.00	1534.8	0.07

CRUISE 924365 STATION SEA 4 7 LATITUDE 14 43.0 N LONGITUDE 120 11.2 E MARSDEN SQUARE 0

DATE 22 JAN 65 TIME 1605 ZONE -8 DEPTH 58 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	25.9	0.02	33.54	0.01	0.0520	0.0000	21.99	0.00	1535.3	0.07
10.	1.00	25.9	0.02	33.54	0.01	0.0519	0.0000	22.00	0.00	1535.4	0.07
20.	1.00	25.8	0.02	33.55	0.01	0.0518	0.0000	22.04	0.00	1535.3	0.07
30.	1.00	25.7	0.02	33.54	0.01	0.0517	0.0000	22.06	0.00	1535.2	0.07
40.	1.00	25.5	0.02	33.61	0.01	0.0517	0.0000	22.15	0.00	1535.2	0.07
50.	1.00	25.5	0.02	33.66	0.01	0.0517	0.0000	22.21	0.00	1535.3	0.07

CRUISE — 965 STATION SEA 4 8 LATITUDE 14 46.6 N LONGITUDE 120 12.3 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 1340 ZONE -8 DEPTH 60 AIR TEMP 80.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.8	0.02	33.52	0.01	0.0528	0.0000	21.70	0.00	1537.3	0.07
15.	1.00	26.5	0.02	33.52	0.01	0.0525	0.0000	21.80	0.00	1536.8	0.07
25.	1.00	26.4	0.02	33.52	0.01	0.0524	0.0000	21.82	0.00	1536.8	0.07
35.	1.00	26.2	0.02	33.57	0.01	0.0523	0.0000	21.93	0.00	1536.5	0.07
45.	1.00	25.5	0.02	33.74	0.01	0.0518	0.0000	22.26	0.00	1535.3	0.07
55.	1.00	25.0	0.02	33.86	0.01	0.0515	0.0000	22.50	0.00	1534.5	0.08

CRUISE — 965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1140 ZONE -8 DEPTH 55 AIR TEMP 86.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
3.	1.00	26.3	0.02	33.55	0.01	0.0524	0.0000	21.88	0.00	1536.2	0.07
7.	1.00	26.2	0.02	33.55	0.01	0.0523	0.0000	21.89	0.00	1536.2	0.07
15.	1.00	26.1	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1536.1	0.07
25.	1.00	25.9	0.02	33.60	0.01	0.0522	0.0000	22.00	0.00	1536.0	0.07
35.	1.00	25.6	0.02	33.69	0.01	0.0519	0.0000	22.20	0.00	1535.3	0.07
50.	1.00	24.8	0.02	33.99	0.01	0.0513	0.0000	22.60	0.00	1533.8	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1310 ZONE -8 DEPTH 55 AIR TEMP 85.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.55	0.01	0.0525	0.0000	21.83	0.00	1536.6	0.07
15.	1.00	26.1	0.02	33.56	0.01	0.0522	0.0000	21.93	0.00	1536.1	0.07
25.	1.00	26.1	0.02	33.57	0.01	0.0522	0.0000	21.95	0.00	1536.1	0.07
35.	1.00	26.0	0.02	33.59	0.01	0.0522	0.0000	21.99	0.00	1536.1	0.07
50.	1.00	25.6	0.02	33.67	0.01	0.0519	0.0000	22.18	0.00	1535.3	0.07
50.	1.00	24.8	0.02	33.89	0.01	0.0514	0.0000	22.57	0.00	1534.0	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1400 ZONE -8 DEPTH 55 AIR TEMP 85.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.5	0.02	33.56	0.01	0.0526	0.0000	21.80	0.00	1536.8	0.07
15.	1.00	26.1	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1536.1	0.07
25.	1.00	26.1	0.02	33.57	0.01	0.0522	0.0000	21.95	0.00	1536.2	0.07
30.	1.00	26.1	0.02	33.59	0.01	0.0522	0.0000	21.97	0.00	1536.2	0.07
35.	1.00	25.6	0.02	33.68	0.01	0.0519	0.0000	22.18	0.00	1535.4	0.07
50.	1.00	0.0	0.00	33.87	0.01	0.0282	0.0000	27.22	0.01	1448.6	0.03

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1500 ZONE -8 DEPTH 55 AIR TEMP 84.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.55	0.01	0.0525	0.0000	21.83	0.00	1536.6	0.07
15.	1.00	26.2	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1536.1	0.07
25.	1.00	26.1	0.02	33.56	0.01	0.0522	0.0000	21.94	0.00	1536.2	0.07
30.	1.00	26.1	0.02	33.59	0.01	0.0522	0.0000	21.97	0.00	1536.2	0.07
35.	1.00	25.6	0.02	33.69	0.01	0.0519	0.0000	22.18	0.00	1535.4	0.07
50.	1.00	25.0	0.02	33.87	0.01	0.0515	0.0000	22.52	0.00	1534.3	0.08

CRUISE — 965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1600 ZONE -8 DEPTH 55 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.89	0.00	1535.9	0.07
15.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.88	0.00	1536.2	0.07
25.	1.00	26.2	0.02	33.53	0.01	0.0522	0.0000	21.90	0.00	1536.3	0.07
30.	1.00	26.1	0.02	33.55	0.01	0.0522	0.0000	21.93	0.00	1536.3	0.07
35.	1.00	25.7	0.02	33.63	0.01	0.0519	0.0000	22.12	0.00	1535.5	0.07
50.	1.00	25.5	0.02	33.81	0.01	0.0515	0.0000	22.45	0.00	1534.4	0.08

CRUISE — 965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1700 ZONE -8 DEPTH 55 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.5	0.02	33.55	0.01	0.0526	0.0000	21.81	0.00	1536.6	0.07
15.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.89	0.00	1536.1	0.07
25.	1.00	26.1	0.02	33.52	0.01	0.0522	0.0000	21.90	0.00	1536.3	0.07
30.	1.00	26.1	0.02	33.53	0.01	0.0522	0.0000	21.91	0.00	1536.3	0.07
35.	1.00	25.7	0.02	33.62	0.01	0.0519	0.0000	22.11	0.00	1535.5	0.07
50.	1.00	25.1	0.02	33.79	0.01	0.0515	0.0000	22.43	0.00	1534.4	0.08

CRUISE — 965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 1900 ZONE -8 DEPTH 55 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.51	0.01	0.0523	0.0000	21.84	0.00	1536.2	0.07
15.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.88	0.00	1536.2	0.07
25.	1.00	26.1	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1536.3	0.07
30.	1.00	25.9	0.02	33.61	0.01	0.0521	0.0000	22.03	0.00	1535.9	0.07
35.	1.00	25.6	0.02	33.64	0.01	0.0518	0.0000	22.16	0.00	1535.3	0.07
50.	1.00	25.1	0.02	33.78	0.01	0.0515	0.0000	22.41	0.00	1534.5	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 2000 ZONE -8 DEPTH 55 AIR TEMP 81.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.01	0.0524	0.0000	21.85	0.00	1536.3	0.07
15.	1.00	26.2	0.02	33.53	0.01	0.0523	0.0000	21.88	0.00	1536.3	0.07
25.	1.00	26.2	0.02	33.56	0.01	0.0523	0.0000	21.92	0.00	1536.4	0.07
30.	1.00	25.8	0.02	33.60	0.01	0.0520	0.0000	22.06	0.00	1535.6	0.07
35.	1.00	25.6	0.02	33.66	0.01	0.0518	0.0000	22.18	0.00	1535.3	0.07
50.	1.00	24.9	0.02	33.82	0.01	0.0514	0.0000	22.50	0.00	1534.1	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 2100 ZONE -8 DEPTH 55 AIR TEMP 81.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.5	0.02	33.51	0.01	0.0525	0.0000	21.79	0.00	1536.6	0.07
15.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.88	0.00	1536.2	0.07
25.	1.00	26.0	0.02	33.55	0.01	0.0521	0.0000	21.96	0.00	1536.0	0.07
30.	1.00	25.8	0.02	33.59	0.01	0.0519	0.0000	22.07	0.00	1535.5	0.07
35.	1.00	25.5	0.02	33.65	0.01	0.0518	0.0000	22.18	0.00	1535.2	0.07
50.	1.00	24.9	0.02	33.83	0.01	0.0514	0.0000	22.50	0.00	1534.2	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 2200 ZONE -8 DEPTH 55 AIR TEMP 80.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.5	0.02	33.51	0.01	0.0525	0.0000	21.78	0.00	1536.6	0.07
15.	1.00	26.1	0.02	33.55	0.01	0.0521	0.0000	21.94	0.00	1535.9	0.07
25.	1.00	26.0	0.02	33.55	0.01	0.0521	0.0000	21.97	0.00	1535.9	0.07
30.	1.00	25.9	0.02	33.57	0.01	0.0520	0.0000	22.02	0.00	1535.8	0.07
35.	1.00	25.4	0.02	33.66	0.01	0.0517	0.0000	22.22	0.00	1534.9	0.07
50.	1.00	25.0	0.02	33.79	0.01	0.0514	0.0000	22.44	0.00	1534.4	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 17 FEB 65 TIME 2300 ZONE -8 DEPTH 55 AIR TEMP 79.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.51	0.01	0.0525	0.0000	21.80	0.00	1536.5	0.07
15.	1.00	26.1	0.02	33.55	0.01	0.0521	0.0000	21.94	0.00	1535.9	0.07
25.	1.00	26.0	0.02	33.55	0.01	0.0521	0.0000	21.96	0.00	1536.0	0.07
30.	1.00	25.8	0.02	33.58	0.01	0.0519	0.0000	22.04	0.00	1535.7	0.07
35.	1.00	25.5	0.02	33.65	0.01	0.0517	0.0000	22.19	0.00	1535.1	0.07
50.	1.00	25.0	0.02	33.80	0.01	0.0514	0.0000	22.45	0.00	1534.3	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0000 ZONE -8 DEPTH 55 AIR TEMP 78.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.51	0.01	0.0524	0.0000	21.81	0.00	1536.4	0.07
15.	1.00	26.0	0.02	33.55	0.01	0.0521	0.0000	21.95	0.00	1535.9	0.07
25.	1.00	26.0	0.02	33.55	0.01	0.0521	0.0000	21.96	0.00	1536.0	0.07
30.	1.00	25.8	0.02	33.58	0.01	0.0519	0.0000	22.04	0.00	1535.7	0.07
35.	1.00	25.6	0.02	33.65	0.01	0.0518	0.0000	22.17	0.00	1535.2	0.07
50.	1.00	25.0	0.02	33.82	0.01	0.0514	0.0000	22.48	0.00	1534.3	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0110 ZONE -8 DEPTH 55 AIR TEMP 78.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.54	0.01	0.0524	0.0000	21.86	0.00	1536.2	0.07
15.	1.00	26.1	0.02	33.56	0.01	0.0522	0.0000	21.95	0.00	1536.0	0.07
25.	1.00	26.0	0.02	33.58	0.01	0.0521	0.0000	21.99	0.00	1536.0	0.07
30.	1.00	25.8	0.02	33.61	0.01	0.0519	0.0000	22.08	0.00	1535.6	0.07
35.	1.00	25.7	0.02	33.64	0.01	0.0519	0.0000	22.14	0.00	1535.4	0.07
50.	1.00	25.0	0.02	33.82	0.01	0.0514	0.0000	22.48	0.00	1534.3	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0200 ZONE -8 DEPTH 55 AIR TEMP 76.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.52	0.00	0.0523	0.0000	21.87	-0.01	1536.0	0.06
15.	1.00	26.1	0.02	33.55	0.00	0.0522	0.0000	21.93	-0.01	1536.1	0.06
20.	1.00	26.0	0.02	33.56	0.00	0.0521	0.0000	21.96	-0.01	1536.0	0.06
25.	1.00	25.9	0.02	33.59	0.01	0.0520	0.0000	22.03	0.00	1535.7	0.07
35.	1.00	25.6	0.02	33.64	0.01	0.0518	0.0000	22.14	0.00	1535.4	0.07
50.	1.00	25.0	0.02	33.82	0.01	0.0514	0.0000	22.48	0.00	1534.2	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0300 ZONE -8 DEPTH 55 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.88	0.00	1536.0	0.07
15.	1.00	26.1	0.02	33.55	0.01	0.0522	0.0000	21.94	0.00	1536.0	0.07
25.	1.00	25.9	0.02	33.59	0.01	0.0520	0.0000	22.03	0.00	1535.7	0.07
30.	1.00	25.7	0.02	33.61	0.01	0.0519	0.0000	22.09	0.00	1535.5	0.07
35.	1.00	25.6	0.02	33.64	0.01	0.0518	0.0000	22.15	0.00	1535.3	0.07
50.	1.00	25.0	0.02	33.83	0.01	0.0514	0.0000	22.49	0.00	1534.3	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0400 ZONE -8 DEPTH 55 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.52	0.01	0.0522	0.0000	21.88	0.00	1536.0	0.07
15.	1.00	26.1	0.02	33.56	0.01	0.0522	0.0000	21.95	0.00	1536.0	0.07
25.	1.00	25.8	0.02	33.61	0.01	0.0519	0.0000	22.08	0.00	1535.5	0.07
30.	1.00	25.7	0.02	33.62	0.01	0.0519	0.0000	22.11	0.00	1535.4	0.07
35.	1.00	25.6	0.02	33.66	0.01	0.0518	0.0000	22.17	0.00	1535.3	0.07
50.	1.00	25.0	0.02	33.82	0.01	0.0515	0.0000	22.46	0.00	1534.4	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 15 FEB 65 TIME 0520 ZONE -8 DEPTH 55 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
[illegible]	[illegible]	26.2	0.02	33.53	0.01	0.0522	0.0000	21.89	0.00	1535.9	0.07
[illegible]	[illegible]	[illegible].1	0.02	33.56	0.01	0.0522	0.0000	21.93	0.00	1536.1	0.07
[illegible]	[illegible]	25.9	0.02	33.65	0.01	0.0520	0.0000	22.04	0.00	1535.7	0.07
[illegible]	[illegible]	[illegible].7	0.02	33.64	0.01	0.0519	0.0000	22.14	0.00	1535.4	0.07
[illegible]	[illegible]	25.6	0.02	33.66	0.01	0.0518	0.0000	22.17	0.00	1535.3	0.07
[illegible]	[illegible]	25.1	0.02	33.80	0.01	0.0516	0.0000	22.44	0.00	1534.8	0.07

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 16 FEB 65 TIME 0600 ZONE -8 DEPTH 55 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.54	0.01	0.0522	0.0000	21.91	0.00	1535.9	0.07
15.	1.00	26.2	0.02	33.58	0.01	0.0523	0.0000	21.94	0.00	1536.2	0.07
25.	1.00	25.8	0.02	33.62	0.01	0.0520	0.0000	22.07	0.00	1535.6	0.07
30.	1.00	25.6	0.02	33.64	0.01	0.0518	0.0000	22.15	0.00	1535.3	0.07
35.	1.00	25.5	0.02	33.70	0.01	0.0518	0.0000	22.22	0.00	1535.2	0.07
50.	1.00	24.9	0.02	33.86	0.01	0.0514	0.0000	22.54	0.00	1534.0	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0700 ZONE -8 DEPTH 55 AIR TEMP 76.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1535.9	0.07
15.	1.00	26.2	0.02	33.56	0.01	0.0523	0.0000	21.92	0.00	1536.2	0.07
25.	1.00	26.1	0.02	33.58	0.01	0.0522	0.0000	21.95	0.00	1536.2	0.07
30.	1.00	25.7	0.02	33.64	0.01	0.0519	0.0000	22.12	0.00	1535.5	0.07
35.	1.00	25.5	0.02	33.69	0.01	0.0518	0.0000	22.21	0.00	1535.2	0.07
50.	1.00	24.9	0.02	33.87	0.01	0.0514	0.0000	22.55	0.00	1534.1	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0800 ZONE -8 DEPTH 55 AIR TEMP 77.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.01	0.0522	0.0000	21.92	0.00	1535.9	0.07
15.	1.00	26.2	0.02	33.56	0.01	0.0523	0.0000	21.92	0.00	1536.2	0.07
25.	1.00	26.1	0.02	33.57	0.01	0.0522	0.0000	21.94	0.00	1536.3	0.07
35.	1.00	25.8	0.02	33.62	0.01	0.0520	0.0000	22.07	0.00	1535.7	0.07
45.	1.00	25.6	0.02	33.69	0.01	0.0518	0.0000	22.20	0.00	1535.3	0.07
55.	1.00	24.9	0.02	33.87	0.01	0.0514	0.0000	22.55	0.00	1534.1	0.08

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 0830 ZONE -8 DEPTH 55 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.90	-0.01	1536.0	0.06
15.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.90	-0.01	1536.2	0.06
25.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.91	-0.01	1536.3	0.06
35.	1.00	25.9	0.02	33.61	0.00	0.0520	0.0000	22.05	-0.01	1535.8	0.06
45.	1.00	25.6	0.02	33.67	0.00	0.0519	0.0000	22.18	-0.01	1535.3	0.06
55.	1.00	24.9	0.02	33.86	0.00	0.0514	0.0000	22.54	-0.01	1534.0	0.06

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1000 ZONE -8 DEPTH 55 AIR TEMP 85.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.90	-0.01	1536.0	0.06
15.	1.00	26.2	0.02	33.56	0.00	0.0523	0.0000	21.91	-0.01	1536.2	0.06
25.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.91	-0.01	1536.3	0.06
35.	1.00	25.8	0.02	33.59	0.00	0.0522	0.0000	21.98	-0.01	1536.2	0.06
45.	1.00	25.7	0.02	33.66	0.00	0.0519	0.0000	22.15	-0.01	1535.5	0.06
55.	1.00	24.9	0.02	33.86	0.00	0.0513	0.0000	22.55	-0.01	1534.0	0.06

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1100 ZONE -8 DEPTH 55 AIR TEMP 85.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.89	-0.01	1536.1	0.06
15.	1.00	26.2	0.02	33.56	0.00	0.0523	0.0000	21.92	-0.01	1536.2	0.06
25.	1.00	26.1	0.02	33.56	0.00	0.0522	0.0000	21.93	-0.01	1536.3	0.06
30.	1.00	26.1	0.02	33.59	0.00	0.0522	0.0000	21.97	-0.01	1536.2	0.06
35.	1.00	25.7	0.02	33.66	0.00	0.0519	0.0000	22.14	-0.01	1535.5	0.06
50.	1.00	24.9	0.02	33.86	0.00	0.0514	0.0000	22.54	-0.01	1534.1	0.06

CRUISE —965 STATION SEA 4 9 LATITUDE 14 46.6 N LONGITUDE 120 12.6 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1140 ZONE -8 DEPTH 55 AIR TEMP 86.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.89	-0.01	1536.1	0.06
15.	1.00	26.2	0.02	33.56	0.00	0.0523	0.0000	21.91	-0.01	1536.2	0.06
25.	1.00	26.1	0.02	33.58	0.00	0.0523	0.0000	21.94	-0.01	1536.3	0.06
30.	1.00	26.1	0.02	33.58	0.00	0.0522	0.0000	21.96	-0.01	1536.3	0.06
35.	1.00	25.7	0.02	33.63	0.00	0.0519	0.0000	22.10	-0.01	1535.6	0.06
50.	1.00	24.9	0.02	33.86	0.00	0.0514	0.0000	22.54	-0.01	1534.1	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1600 ZONE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.5	0.02	33.54	0.00	0.0526	0.0000	21.81	-0.01	1536.6	0.06
10.	1.00	26.4	0.02	33.54	0.00	0.0525	0.0000	21.82	-0.01	1536.7	0.06
20.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.89	-0.01	1536.4	0.06
30.	1.00	26.2	0.02	33.54	0.00	0.0522	0.0000	21.91	-0.01	1536.4	0.06
35.	1.00	26.2	0.02	33.54	0.00	0.0522	0.0000	21.91	-0.01	1536.5	0.06
40.	1.00	26.0	0.02	33.57	0.00	0.0522	0.0000	21.97	-0.01	1536.3	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1700 ZONE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.52	0.00	0.0525	0.0000	21.82	-0.01	1536.4	0.06
10.	1.00	26.4	0.02	33.52	0.00	0.0525	0.0000	21.81	-0.01	1536.6	0.06
20.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.6	0.06
30.	1.00	26.2	0.02	33.53	0.00	0.0522	0.0000	21.90	-0.01	1536.4	0.06
35.	1.00	26.2	0.02	33.53	0.00	0.0522	0.0000	21.90	-0.01	1536.5	0.06
43.	1.00	26.1	0.02	33.54	0.00	0.0521	0.0000	21.93	-0.01	1536.4	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1800 ZONE -8 DEPTH 43 AIR TEMP 83.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.52	0.00	0.0525	0.0000	21.81	-0.01	1536.5	0.06
10.	1.00	26.4	0.02	33.51	0.00	0.0525	0.0000	21.80	-0.01	1536.7	0.06
20.	1.00	26.4	0.02	33.52	0.00	0.0524	0.0000	21.82	-0.01	1536.7	0.06
30.	1.00	26.2	0.02	33.52	0.00	0.0522	0.0000	21.89	-0.01	1536.4	0.06
35.	1.00	26.2	0.02	33.52	0.00	0.0522	0.0000	21.89	-0.01	1536.5	0.06
43.	1.00	26.1	0.02	33.54	0.00	0.0522	0.0000	21.93	-0.01	1536.4	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 1900 ZONE -8 DEPTH 43 AIR TEMP 80.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.53	0.00	0.0525	0.0000	21.82	-0.01	1536.5	0.06
10.	1.00	26.4	0.02	33.54	0.00	0.0525	0.0000	21.83	-0.01	1536.6	0.06
20.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.89	-0.01	1536.4	0.06
30.	1.00	26.2	0.02	33.53	0.00	0.0522	0.0000	21.90	-0.01	1536.4	0.06
35.	1.00	26.0	0.02	33.55	0.00	0.0521	0.0000	21.96	-0.01	1536.2	0.06
43.	1.00	25.9	0.02	33.61	0.00	0.0520	0.0000	22.07	-0.01	1535.8	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 2000 ZONE -8 DEPTH 43 AIR TEMP 83.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.51	0.00	0.0525	0.0000	21.80	-0.01	1536.5	0.06
10.	1.00	26.4	0.02	33.51	0.00	0.0525	0.0000	21.80	-0.01	1536.7	0.06
20.	1.00	26.2	0.02	33.51	0.00	0.0523	0.0000	21.86	-0.01	1536.3	0.06
30.	1.00	26.0	0.02	33.55	0.00	0.0520	0.0000	21.98	-0.01	1536.0	0.06
35.	1.00	25.8	0.02	33.59	0.00	0.0520	0.0000	22.05	-0.01	1535.8	0.06
40.	1.00	25.5	0.02	33.66	0.00	0.0518	0.0000	22.18	-0.01	1535.3	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 2100 ZONE -8 DEPTH 43 AIR TEMP 80.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.51	0.00	0.0524	0.0000	21.81	-0.01	1536.4	0.06
10.	1.00	26.4	0.02	33.51	0.00	0.0524	0.0000	21.81	-0.01	1536.6	0.06
20.	1.00	26.0	0.02	33.54	0.00	0.0521	0.0000	21.94	-0.01	1536.0	0.06
30.	1.00	25.9	0.02	33.58	0.00	0.0520	0.0000	22.03	-0.01	1535.8	0.06
35.	1.00	25.8	0.02	33.61	0.00	0.0519	0.0000	22.08	-0.01	1535.6	0.06
40.	1.00	25.5	0.02	33.66	0.00	0.0518	0.0000	22.19	-0.01	1535.2	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 2200 ZONE -8 DEPTH 43 AIR TEMP 79.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.51	0.00	0.0524	0.0000	21.81	-0.01	1536.4	0.06
10.	1.00	26.1	0.02	33.54	0.00	0.0522	0.0000	21.92	-0.01	1535.9	0.06
20.	1.00	25.9	0.02	33.56	0.00	0.0520	0.0000	22.00	-0.01	1535.7	0.06
30.	1.00	25.4	0.02	33.68	0.00	0.0517	0.0000	22.24	-0.01	1534.8	0.06
35.	1.00	25.1	0.02	33.76	0.00	0.0515	0.0000	22.38	-0.01	1534.4	0.06
40.	1.00	25.0	0.02	33.79	0.00	0.0514	0.0000	22.45	-0.01	1534.1	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 18 FEB 65 TIME 2300 ZONE -8 DEPTH 43 AIR TEMP 78.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.4	0.02	33.52	0.00	0.0524	0.0000	21.83	-0.01	1536.3	0.06
10.	1.00	26.2	0.02	33.54	0.00	0.0522	0.0000	21.91	-0.01	1536.1	0.06
20.	1.00	26.1	0.02	33.55	0.00	0.0521	0.0000	21.94	-0.01	1536.0	0.06
30.	1.00	25.8	0.02	33.59	0.00	0.0520	0.0000	22.04	-0.01	1535.7	0.06
35.	1.00	25.7	0.02	33.64	0.00	0.0519	0.0000	22.14	-0.01	1535.4	0.06
40.	1.00	25.5	0.02	33.68	0.00	0.0518	0.0000	22.21	-0.01	1535.2	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0000 ZONE -8 DEPTH 43 AIR TEMP 77.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.84	-0.01	1536.3	0.06
10.	1.00	26.4	0.02	33.53	0.00	0.0524	0.0000	21.84	-0.01	1536.5	0.06
20.	1.00	26.1	0.02	33.55	0.00	0.0522	0.0000	21.92	-0.01	1536.2	0.06
30.	1.00	25.8	0.02	33.60	0.00	0.0520	0.0000	22.06	-0.01	1535.7	0.06
35.	1.00	25.8	0.02	33.62	0.00	0.0520	0.0000	22.08	-0.01	1535.7	0.06
40.	1.00	25.6	0.02	33.66	0.00	0.0518	0.0000	22.18	-0.01	1535.3	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0100 ZONE -8 DEPTH 43 AIR TEMP 76.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.3	0.06
10.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.4	0.06
20.	1.00	26.2	0.02	33.54	0.00	0.0522	0.0000	21.91	-0.01	1536.2	0.06
30.	1.00	25.9	0.02	33.59	0.00	0.0520	0.0000	22.04	-0.01	1535.8	0.06
35.	1.00	25.7	0.02	33.63	0.00	0.0519	0.0000	22.11	-0.01	1535.5	0.06
40.	1.00	25.6	0.02	33.65	0.00	0.0518	0.0000	22.16	-0.01	1535.4	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0200 ZONE -8 DEPTH 43 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.3	0.06
10.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.4	0.06
20.	1.00	26.2	0.02	33.54	0.00	0.0522	0.0000	21.90	-0.01	1536.3	0.06
30.	1.00	26.1	0.02	33.55	0.00	0.0522	0.0000	21.94	-0.01	1536.2	0.06
35.	1.00	25.9	0.02	33.58	0.00	0.0520	0.0000	22.02	-0.01	1535.9	0.06
40.	1.00	25.6	0.02	33.65	0.00	0.0518	0.0000	22.16	-0.01	1535.4	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0300 ZONE -8 DEPTH 43 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.85	-0.01	1536.2	0.06
10.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.86	-0.01	1536.4	0.06
20.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.89	-0.01	1536.4	0.06
30.	1.00	26.1	0.02	33.55	0.00	0.0522	0.0000	21.92	-0.01	1536.4	0.06
35.	1.00	26.0	0.02	33.58	0.00	0.0521	0.0000	22.00	-0.01	1536.1	0.06
40.	1.00	25.8	0.02	33.61	0.00	0.0520	0.0000	22.06	-0.01	1535.9	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0400 ZONE -8 DEPTH 43 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.3	0.02	33.53	0.00	0.0524	0.0000	21.86	-0.01	1536.2	0.06
10.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.89	-0.01	1536.2	0.06
20.	1.00	26.1	0.02	33.55	0.00	0.0522	0.0000	21.93	-0.01	1536.1	0.06
30.	1.00	25.7	0.02	33.62	0.00	0.0519	0.0000	22.11	-0.01	1535.4	0.06
35.	1.00	25.6	0.02	33.67	0.00	0.0518	0.0000	22.19	-0.01	1535.2	0.06
40.	1.00	25.1	0.02	33.79	0.00	0.0515	0.0000	22.43	-0.01	1534.3	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE C

DATE 19 FEB 65 TIME 0500 ZONE -8 DEPTH 43 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.88	-0.01	1536.1	0.06
10.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.89	-0.01	1536.2	0.06
20.	1.00	25.9	0.02	33.57	0.00	0.0520	0.0000	22.01	-0.01	1535.7	0.06
30.	1.00	25.5	0.02	33.67	0.00	0.0518	0.0000	22.20	-0.01	1535.1	0.06
35.	1.00	25.3	0.02	33.74	0.00	0.0517	0.0000	22.32	-0.01	1534.8	0.06
40.	1.00	25.1	0.02	33.79	0.00	0.0515	0.0000	22.40	-0.01	1534.5	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0600 ZONE -8 DEPTH 43 AIR TEMP 0.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.00	0.0523	0.0000	21.91	-0.01	1536.0	0.06
10.	1.00	26.2	0.02	33.54	0.00	0.0523	0.0000	21.90	-0.01	1536.1	0.06
20.	1.00	26.1	0.02	33.56	0.00	0.0522	0.0000	21.95	-0.01	1536.0	0.06
30.	1.00	25.7	0.02	33.66	0.00	0.0519	0.0000	22.15	-0.01	1535.4	0.06
35.	1.00	25.4	0.02	33.71	0.00	0.0517	0.0000	22.26	-0.01	1535.0	0.06
40.	1.00	25.2	0.02	33.75	0.00	0.0516	0.0000	22.35	-0.01	1534.6	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0700 ZONE -8 DEPTH 43 AIR TEMP 75.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.2	0.02	33.55	0.00	0.0522	0.0000	21.92	-0.01	1535.9	0.06
10.	1.00	26.2	0.02	33.56	0.00	0.0523	0.0000	21.92	-0.01	1536.1	0.06
20.	1.00	26.1	0.02	33.56	0.00	0.0522	0.0000	21.93	-0.01	1536.2	0.06
30.	1.00	25.7	0.02	33.64	0.00	0.0519	0.0000	22.12	-0.01	1535.5	0.06
35.	1.00	25.6	0.02	33.67	0.00	0.0519	0.0000	22.17	-0.01	1535.4	0.06
40.	1.00	25.4	0.02	33.72	0.00	0.0517	0.0000	22.28	-0.01	1535.0	0.06

CRUISE —965 STATION SEA 4 10 LATITUDE 14 46.6 N LONGITUDE 120 12.9 E MARSDEN SQUARE 0

DATE 19 FEB 65 TIME 0800 ZONE -8 DEPTH 43 AIR TEMP 80.0 TEMP INSTR RTH SAL INSTR NAN

DEPTH	DEV.	TEMP	DEV.	SALINITY	DEV.	ELEC. COND.	DEV.	SIGMA-T	DEV.	SOUND VEL.	DEV.
0.	1.00	26.1	0.02	33.52	0.00	0.0522	0.0000	21.90	-0.01	1535.8	0.06
10.	1.00	26.1	0.02	33.52	0.00	0.0522	0.0000	21.90	-0.01	1536.0	0.06
20.	1.00	26.0	0.02	33.54	0.00	0.0521	0.0000	21.96	-0.01	1535.8	0.06
30.	1.00	25.7	0.02	33.60	0.00	0.0519	0.0000	22.08	-0.01	1535.5	0.06
35.	1.00	25.6	0.02	33.64	0.00	0.0518	0.0000	22.16	-0.01	1535.3	0.06
43.	1.00	25.3	0.02	33.68	0.00	0.0516	0.0000	22.27	-0.01	1534.8	0.06

APPENDIX B

Core Analysis Summary Sheets

1. Engineering Properties
2. Sediment Size and Composition

1. EXPLANATION OF DATA PAGES
CORE ANALYSIS SUMMARY SHEET
Engineering Properties

Results of engineering properties, core analysis performed by the U. S. Naval Oceanographic Office Geological Laboratory are recorded on Core Analysis Summary Sheet Engineering Properties.

The following is a description of the terms employed on the Core Analysis Summary Sheet:

1. Cruise Number. A number assigned to each cruise for identification purposes.

2. Latitude. Expressed in degrees, minutes, and seconds.

3. Longitude. Expressed in degrees, minutes, and seconds.

4. Sample Number. A consecutive number, commencing with 1, applied to each core taken successively throughout the cruise.

5. Date Taken. Day (GMT), month, and year.

6. Water Depth (m). The uncorrected sonic sounding recorded in meters.

7. Type Corer. Identified by the name of device employed.

8. Core Length(cm). Recorded in centimeters as observed in the laboratory.

9. Core Penetration (cm). Recorded in centimeters as observed in the field.

10. Subsample Depth in Core (cm). Interval of subsample as measured in centimeters from the top of the core.

11. Wet Unit Weight (g/cm^3). The weight (solids plus water) per unit volume of the sediment mass.

12. Specific Gravity of Solids. The ratio of weight in air of a given volume of a sediment at 20°C to the weight in air of an equal volume of distilled water at 20°C.

13. Water Content (% dry weight). The ratio, in percent, of the weight of water in a given mass of the sediment sample to the weight of the solid particles.

14. Void Ratio. The ratio of the volume of void spaces to the volume of solid particles in the sediment sample as computed from Wet Unit Weight, Specific Gravity of Solids, and Water Content.

15. Saturated Void Ratio. The Void Ratio at 100 percent saturation as computed from Water Content and Specific Gravity of Solids.

$$\text{Saturated Void Ratio} = \frac{\text{Water Content X Specific Gravity of Solids}}{100}$$

16. Porosity (σ_0). The ratio, usually expressed as a percentage, of the volume of voids of a sediment mass to the total volume of the sediment mass.

17. Liquid Limit. Water Content, in percent, at which a pat of sediment cut by a groove of standard dimension will flow together for a distance of 1/2 inch under the impact of 25 blows in a standard liquid limit apparatus.

18. Plastic Limit. Water Content, in percent, at which a sediment will just begin to crumble when rolled into a thread approximately 1/8 inch in diameter.

19. Plasticity Index. The numerical difference between the Liquid Limit and Plastic Limit of the sediment mass.

20. Liquidity Index. The ratio, expressed in percentage, of (1) the natural water content of the sediment sample minus its Plastic Limit to (2) its Plasticity Index.

21. Compression Index. The slope of the linear portion of the Pressure-Void Ratio curve on a semi-log plot.

22. Compressive Strength. The load per unit area required to shear an unconfined, natural or remolded, sediment mass.

23. Cohesion. The shearing strength per unit area under zero externally applied load.

24. Sensitivity. The ratio of the natural to the remolded strength. It is a measure of the loss of strength due to remolding the sediment mass.

25. Angle of Internal Friction (°). The angle between the abscissa and the tangent of the curve representing the relationship of "shearing resistance" to "normal stress" acting within a sediment mass.

26. Activity. The ratio of the Plasticity Index to the clay fraction percentage (< .002 mm) of the sediment mass.

27. Modulus of Elasticity. The ratio of stress to strain of the sediment mass.

28. Slump (%). The ratio, in percent, of the amount of height change immediately before the compressive strength test to the original height of a cylinder of sediment.

PRNC-NAVOCEANO-3167/18 B (4-63)

CORE ANALYSIS SUMMARY SHEET
ENGINEERING PROPERTIES

EVANS
ANALYZED BY MAGAN
DATE 9 APRIL 65

1. CRUISE NO.
2. LATITUDE 14 ° 46 . 33 ' N
3. LONGITUDE 120 ° 12 . 38 ' E
4. SAMPLE NO. 9-1 B.S.-1
5. DATE TAKEN (Day, month, year) 17 FEB. 65
6. WATER DEPTH (m) 56.5
7. TYPE CORER KOLLENBERG
8. CORE LENGTH (cm) 87
9. CORER PENETRATION (cm)

10. SUBSAMPLE DEPTH IN CORE (cm)	0-10	10-17	17-29	29-36	36-48	50-57	57-69	69-76	76-87			
11. WET UNIT WEIGHT (g/cm^3)		1.52		1.55		1.58						
12. SPECIFIC GRAVITY OF SOLIDS												
13. WATER CONTENT (% dry weight)		81.11		71.49		58.61		54.32				
14. VOID RATIO												
15. SATURATED VOID RATIO												
16. POROSITY (%)												
17. LIQUID LIMIT												
18. PLASTIC LIMIT												
19. PLASTICITY INDEX												
20. LIQUIDITY INDEX												
21. COMPRESSION INDEX FROM LL												
22. COMPRESSIVE STRENGTH NATURAL (g/cm^2)				37.65								
22. COMPRESSIVE STRENGTH REMOLD (g/cm^2)												
23. COHESION NATURAL (g/cm^2)		53.71		28.82		61.73						
23. COHESION REMOLD (g/cm^2)		18.79				8.93						
24. SENSITIVITY		2.86				6.91						
25. ANGLE OF INTERNAL FRICTION (°)												
26. ACTIVITY												
27. MODULUS OF ELASTICITY g/cm^2				468								
28. SLUMP (%)				1.63								

29. REMARKS: GREENISH SANDY MUD. NO RAGS. NO FREE WATER. CORE INJERTED DURING STORAGE. MOISTURE SAMPLES TAKEN JUST ABOVE ENGINEER PROP. SAMPLE. ORGANIC ODOR. FOLDED PLASTIC ON BOTTOM.
DCP @ 29-36CM. HIT FOSSIL WITH TUBE
CORE CUT @ 42CM

ITEM No - 270

PRNC-NAVOCEANO-3167/18 B (4-6…)

CORE ANALYSIS SUMMARY SHEET
ENGINEERING PROPERTIES

ANALYZED BY EVANS MAGAN

DATE 13 APRIL 65

[illegible]	4. SAMPLE NO. 1C 2						Kollenberg				
[illegible] 14° 46' 34"	5. DATE 18 … 65						112				
[illegible] 120° 12' 55.1"	6. WATER DEPTH 43						[illegible]				
[illegible]	0-13	13-20	20-33	33-40	40-53	53-60	60-73	73-80	80-93	93-100	100-111
[illegible]		1.79		1.80		1.76		1.71		1.84	
[illegible]											
[illegible]		42.85		42.93		44.03		41.36		44.96	
[illegible] RATIO											
[illegible]											
[illegible]											
[illegible]											
[illegible]											
[illegible] INDEX											
[illegible] LIQUIDITY INDEX											
[illegible] COMPRESSION INDEX FROM [illegible]											
22. COMPRESSIVE STRENGTH NATURAL (g/cm²)				125.84		116.0		83.66		104.05	
REMOLDED (g/cm²)											
23. COHESION NATURAL (g/cm²)		40.61		62.92		58.0		41.83		52.02	
REMOLDED (g/cm²)		43.59									
24. SENSITIVITY		3.22									
25. ANGLE OF INTERNAL FRICTION (°)											
26. ACTIVITY											
27. MODULUS OF ELASTICITY g/CM²				1014		1083		612		811	
28. SLUMP (%)				1.63		1.65		1.08		2.17	

29. REMARKS No Free Water, Rags In Core. Numerous Shells Could Be Heard Cracking As Sampling Tube Was Pushed Into Core. Sediment Is Desiccated Except Near Bottom At Top. Sediment Is Black In Contact With Core Barrel. Core Cut At 46 & 86 CM.

ITEM No - 270

FRNC-NAVOCEANO-3167/18 B (4-63)

CORE ANALYSIS SUMMARY SHEET
ENGINEERING PROPERTIES

ANALYZED BY EVANS MAGAN

DATE 14 APRIL 65

1. CRUISE NO.
2. LATITUDE 14 ° 46 . 6 '
3. LONGITUDE 20 ° 12 . 5 '
4. SAMPLE NO. B-1 B.S.-3
5. DATE TAKEN (Day, month, year) 19 FEB. 65
6. WATER DEPTH (m) 60
7. TYPE CORER KULLENBERG
8. CORER PENETRATION (cm) 110
9. OTHER PENETRATION (cm)

10. SUBSAMPLE DEPTH IN CORE (cm)	0-13	13-20	20-33	33-40	40-53	53-60	60-73	73-80	80-93	93-100	100-110
11. WET UNIT WEIGHT (g/cm³)		1.46		1.49		1.48		1.67		1.56	
12. SPECIFIC GRAVITY OF SOLIDS											
13. WATER CONTENT (% dry weight)		94.22		105.69		92.94		85.13		71.15	
14. VOID RATIO											
15. SATURATED VOID RATIO											
16. POROSITY (%)											
17. LIQUID LIMIT											
18. PLASTIC LIMIT											
19. PLASTICITY INDEX											
20. LIQUIDITY INDEX											
21. COMPRESSION INDEX FROM LL											
22. COMPRESSIVE STRENGTH NATURAL (g/cm²)				50.76				96.32			
22. COMPRESSIVE STRENGTH REMOLD (g/cm²)											
23. COHESION NATURAL (g/cm²)		35.78		25.38		51.88		48.16		60.88	
23. COHESION REMOLD (g/cm²)		8.92				17.86				14.62	
24. SENSITIVITY		4.01				2.90				4.16	
25. ANGLE OF INTERNAL FRICTION (°)											
26. ACTIVITY											
27. MODULUS OF ELASTICITY g/cm²				437				1296			
28. SLUMP (%)				2.68				2.17			

29. REMARKS GREEN SANDY MUD, NO FREE WATER, BUT NOT OBVIOUSLY DESICATED.
NO BAGS. PLASTIC SHEET IN BOTTOM.
CORE CUT @ 46 & 86 CM.
DEP @ 93 100 CM HIGH % H₂O

ITEM No. 270

35

2. EXPLANATION OF COMPUTER DATA SHEET SEDIMENT SIZE AND COMPOSITION

Results of sediment-size and -composition core analysis performed by the U. S. Naval Oceanographic Office Geological Laboratory are tabulated on Computer Data Sheet Sediment Size and Composition.

The following is an explanation of the terms employed on the Computer Data Sheet:

1. CRUISE. A number assigned to each cruise for identification purposes.

2. SAMPLE. A consecutive number applied to each core taken successively throughout the cruise.

3. LATITUDE. Expressed in degrees, minutes, and tenths of minutes.

4. LONGITUDE. Expressed in degrees, minutes, and tenths of minutes.

5. TAKEN. Date in month, day, and year that core was taken.

6. CORER TYPE. Number corresponding to sampling device code below.

1. Hydroplastic piston	6. Orange Peel
2. Hydroplastic gravity	7. Ewing
3. Kullenberg piston	8. Vibrocorer
4. Kullenberg gravity	9. Dredge
5. Phleger gravity	0. Other

7. LENGTH. Length of core recorded in centimeters as observed in the laboratory.

8. PENETRATION. Penetration of coring device recorded in centimeters as observed in the field

9. DEPTH. The uncorrected sonic sounding recorded in meters.

10. ANALYZED. Date in month, day, and year that core was analyzed in the laboratory.

11. ID. NO. Three digit laboratory project number followed by consecutive number assigned to each subsample analyzed.

12. INTERVAL. Interval of subsample as measured in centimeters from the top of the core.

13. MM. Particle diameter size intervals based on Wentworth size grades in millimeters.

14. PER. Percent of total sample weight within the given size interval.

15. GRAVEL, SAND, SILT, CLAY. Percent of total sample weight within the four size classes.

Class ranges are: Gravel - coarser than 2 mm
Sand - 2 to 0.0625 mm
Silt - 0.0625 to 0.0039 mm
Clay - finer than 0.0039 mm

16. MEAN (MM). The geometric mean of the distribution expressed in millimeters.

17. MEAN (PHI). The logarithmic mean of the distribution expressed in phi units ($-\log_2$ of the diameter in millimeters).

18. STAN DEV. Standard deviation. A measure of the degree of spread or dispersion of the distribution about the mean expressed in phi units.

$$\sigma = \sqrt{\sum f (X_i - \bar{X})^2 / 100}$$

19. SKEWNESS. A measure of the asymmetry of the distribution. Positive values denote skewness of the distribution toward the fine particles, negative values denote skewness toward the coarse particles. A normal distribution has a skewness of 0.

$$\alpha_3 = \frac{1}{100} \sigma^{-3} \sum f (X_i - \bar{X})^3$$

20. KURTOSIS. A measure of the peakedness of the distribution. Positive values denote a "leptokurtic" distribution, or a distribution more "peaked" than normal. Negative values denote a "platykurtic" distribution, or a distribution more "flat" than normal. A normal curve has a kurtosis of 0.

$$\alpha_4 = \frac{1}{100} \sigma^{-4} \sum f (X_i - \bar{X})^4 - 3$$

21. $CACO_3$. Percent calcium carbonate of the total sample weight as determined by the insoluble residue method.

22. ORG CARBON. Percent organic carbon of the total sample weight as determined by the Allison method.

23. COLOR. Wet sediment color, based on the Geological Society of America Rock-Color Chart, as determined in the laboratory.

24. DOM MINERAL. Dominant mineral (s) comprising the sample assemblage.

25. SEC MINERAL. Secondary mineral (s) comprising the sample assemblage.

SEDIMENT SIZE AND COMPOSITION DATA

CRUISE | SAMPLE 9-1 | LATITUDE 14 46.6 | LONGITUDE 12 12.6 | TAKEN 7/02/65
CORER TYPE 4 | LENGTH 87.0 | PENETRATION 80.0 | DEPTH [illegible] | ANALYZED 9/04/65

ID. NO.	270 9	270 10	270 11	270 13		
INTERVAL	12.0- 17.0	29.0- 36.0	50.0- 57.0	69.0- 78.0		
MM	PER	PER	PER	PER	PER	PER
[illegible]	[illegible]	[illegible]	0.000	0.000		
2.0000	2.941	0.943	5.396	4.323		
1.0000	3.043	3.393	3.364	3.574		
0.5000	7.201	9.896	10.512	5.486		
0.2500	23.428	22.947	25.929	20.033		
0.1250	16.329	15.080	24.247	25.892		
0.0625	4.462	4.053	4.415	8.479		
0.0312	0.000	0.000	0.000	0.000		
0.0156	9.114	9.708	1.962	4.406		
[illegible]	[illegible]	[illegible]	0.000	0.000		
[illegible]	11.664	9.184	11.963	13.300		
0.0020	0.000	0.000	0.000	0.000		
0.0010	7.099	14.138	4.595	6.234		
0.0005	3.043	3.299	7.358	0.831		
0.0000-	12.677	11.310	0.701	7.481		
GRAVEL	2.941	0.943	5.396	4.323		
SAND	54.462	55.419	68.465	63.425		
SILT	19.777	14.892	13.525	17.706		
CLAY	22.819	28.746	12.614	14.547		
MEAN (MM)	0.0394	0.0360	0.0970	0.0639		
MEAN (PHI)	4.6693	4.7990	3.3655	3.9680		
STAN DEV	3.9954	4.0280	3.4230	3.5681		
SKEWNESS	0.2909	0.2349	0.4647	0.3828		
KURTOSIS	-1.1658	-1.3256	-0.3550	-0.5329		
CACO3	30.900	25.600	30.200	18.800		
ORG CARBON	0.000	0.000	0.000	0.000		
COLOR	5Y 2/1	5Y 2/1	5Y 2/1	5Y 2/1		
DOM MINERAL	QUARTZ	QUARTZ	QUARTZ	QUARTZ		
SEC MINERAL	CALCITE	CALCITE	CALCITE	CALCITE		

SEDIMENT SIZE AN COMPOSITION DATA

CRUISE	SAMPLE 2	LATITUDE 14 46.6	LONGITUDE 120 12.9	TAKEN 10/07/65
CORER TYPE 4	LENGTH 112.0	PENETRATION 120.0	DEPTH 43.0	ANALYZED 13/04/65

LO. NO.	270 26	270 27	270 28	270 29	270 30	
INTERVAL	13.0- 20.0	33.0- 40.0	53.0- 60.0	73.0- 80.0	93.0-100.0	
MM	PER	PER	PER	PER	PER	PER
4.0000	0.000	0.000	0.000	0.000	0.000	
2.0000	3.558	4.261	1.924	2.687	5.521	
1.0000	7.979	8.729	4.918	4.880	6.916	
0.5000	1.624	12.577	13.685	13.932	12.214	
0.2500	25.290	21.718	21.739	20.797	22.699	
0.1250	24.053	17.801	20.242	18.246	20.468	
0.0625	9.867	7.491	8.268	6.223	8.199	
0.0312	0.000	0.000	0.000	0.000	0.000	
0.0156	7.347	5.430	4.989	6.719	7.290	
0.0078	0.000	0.000	0.000	0.000	0.000	
0.0039	5.414	0.278	10.691	10.962	6.693	
0.0020	0.000	0.000	0.000	0.000	0.000	
0.0010	4.254	3.436	3.920	2.829	3.623	
0.0005	1.953	0.344	0.356	1.768	0.279	
0.0000-	9.203	8.935	9.266	10.962	6.135	
GRAVEL	3.558	4.261	1.924	2.687	5.521	
SAND	68.211	68.316	68.852	64.074	70.[illegible]	
SILT	12.761	14.708	15.651	17.660	17.543	
CLAY	19.469	12.715	13.542	15.559	[illegible]	
MEAN (MM)	0.0739	0.0965	0.0776	0.[illegible]	[illegible]	
MEAN (PHI)	3.7204	3.3729	3.6682	3.697[illegible]	[illegible]	
STAN DEV	3.6097	3.6874	3.6004	3.9[illegible]	[illegible]	
SKEWNESS	0.4998	0.5062	0.[illegible]928	0.422	[illegible]	
KURTOSIS	-0.0841	-0.0925	-0.2202	-0.5659	[illegible]	
CACO3	36.100	34.400	32.600	30.500	29.300	
ORG CARBON	0.000	0.000	0.000	0.000	0.000	
COLOR	5Y 4/2	5Y 4/2	5Y 4/2	5Y 4/2	5Y 4/2	
DOM MINERAL	QUARTZ	QUARTZ	QUARTZ	QUARTZ	QUARTZ	
SEC MINERAL	CALCITE	CALCITE	CALCITE	CALCITE	CALCITE	

SEDIMENT SIZE AN COMPOSITION DATA

CRUISE — SAMPLE 3 — LATITUDE 14 46.6 — LONGITUDE 125 12.3 — TAKEN 19/02/65
CORER TYPE 4 — LENGTH 110.0 — PENETRATION 150.0 — DEPTH 60.0 — ANALYZED 14/04/65

LAB. NO.	270 39	270 40	270 41	27 42	270 43	270 44
INTERVAL	13.0- 20.0	33.0- 40.0	53.0- 60.0	73.0- 80.0	93.0 -100.0	105.0-111.0
MM	PER	PER	PER	PER	PER	PER
[illegible]	[illegible]	[illegible]	0.000	0.000	1.000	0.000
2.0000	2.297	0.914	0.416	0.498	1.285	2.029
1.0000	1.148	2.171	1.930	1.664	1.693	4.557
0.5000	1.818	4.664	3.239	2.424	3.367	5.917
0.2500	9.187	14.931	11.822	13.040	19.103	14.797
0.1250	11.252	14.914	10.903	21.761	14.792	17.547
0.0625	7.177	5.371	4.117	11.542	11.448	6.917
0.0312	0.000	0.000	0.000	0.000	0.000	0.000
0.0156	13.694	7.086	7.100	6.667	1.200	3.699
[illegible]	[illegible]	[illegible]	0.000	0.000	0.000	1.000
[illegible]	[illegible]	9.714	16.730	11.628	14.117	19.393
0.0020	[illegible]	2.000	0.000	0.000	0.000	0.000
0.0010	12.913	13.143	7.284	7.890	5.665	8.353
0.0005	9.742	4.000	10.649	12.974	5.023	2.903
0.0000-	16.268	16.571	15.088	11.213	8.492	12.590
GRAVEL	2.297	0.914	0.416	0.498	1.285	2.029
SAND	30.622	45.600	34.451	49.934	65.004	51.313
SILT	32.193	19.771	25.911	17.691	16.327	22.752
CLAY	34.928	33.714	39.022	31.977	17.385	23.866
MEAN (MM)	0.0112	0.0164	0.0093	0.0187	0.0485	0.0284
MEAN (PHI)	6.4789	5.9274	6.7466	5.7434	4.3647	5.1360
STAN DEV	3.7290	4.0077	3.7598	3.8235	3.6356	3.9338
SKEWNESS	-0.1127	0.0164	-0.1099	0.1236	0.3631	0.1368
KURTOSIS	-1.1419	-1.5100	-1.4229	-1.5051	-0.8020	-1.3035
CACO3	29.200	32.800	30.800	24.900	28.700	32.400
ORG CARBON	0.000	0.000	0.000	0.000	0.000	0.000
COLOR	5Y 4/2	5Y 4/2	5Y 4/2	5Y 4/2	5Y 4/2	5Y 4/2
DOM MINERAL	QUARTZ	QUARTZ	QUARTZ	QUARTZ	QUARTZ	QUARTZ
SEC MINERAL	CALCITE	CALCITE	CALCITE	CALCITE	CALCITE	CALCITE

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13. ABSTRACT

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965. The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program. Temperature and salinity measurements and bottom sediment samples were obtained at 10 stations. Two of these stations were time-series anchor stations with current measurements and ambient noise recordings.

The influence of tidal currents are thought to be responsible for the fluctuation of higher density waters through the entrance channel to Subic Bay on either slope of predicted high water.

Maximum current speed was 0.4 knot. Characteristically, flow direction at intermediate levels often differed from the flow of the surface and near-bottom depths.

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